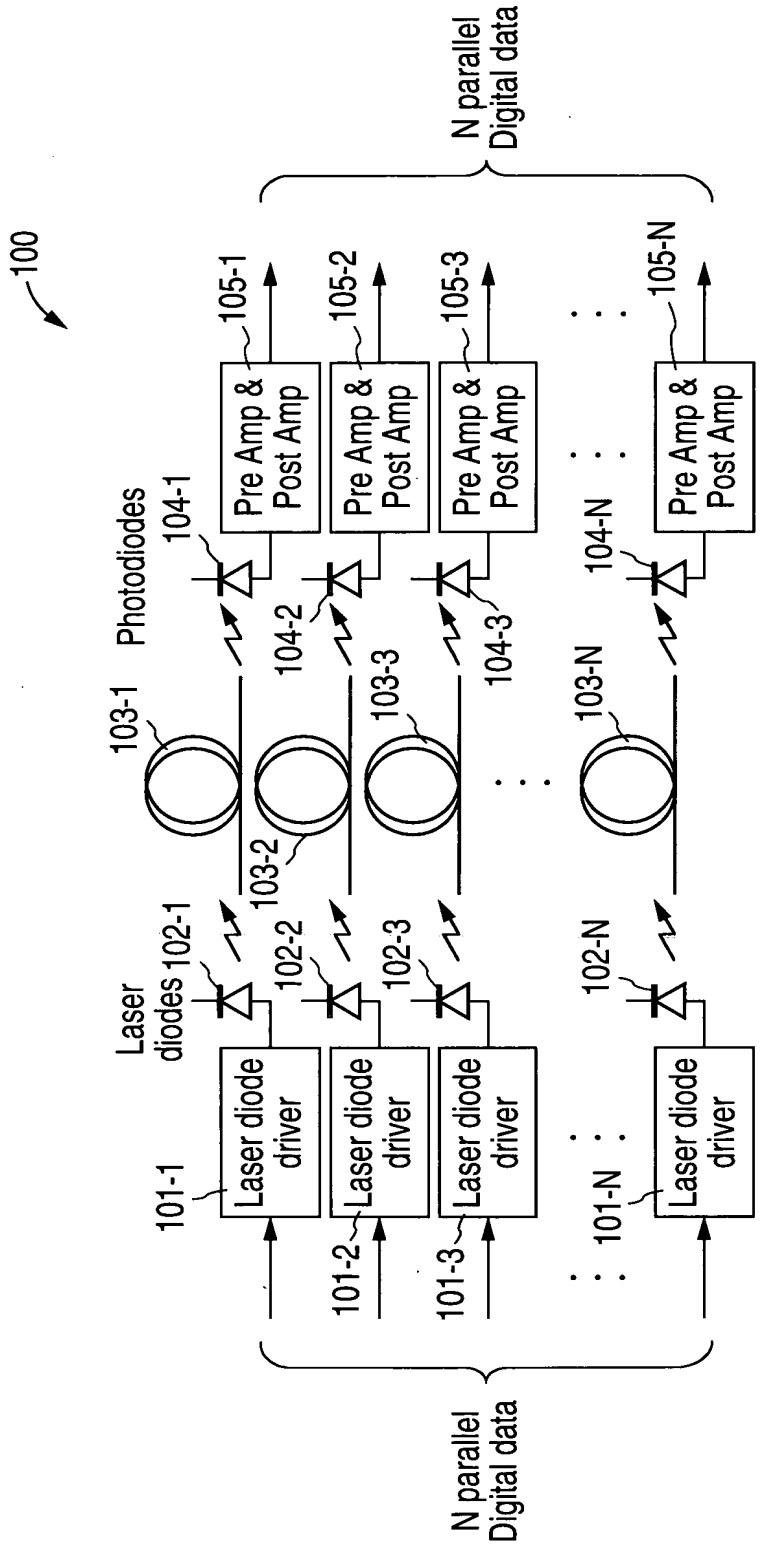


Figure 1A
(PRIOR ART)

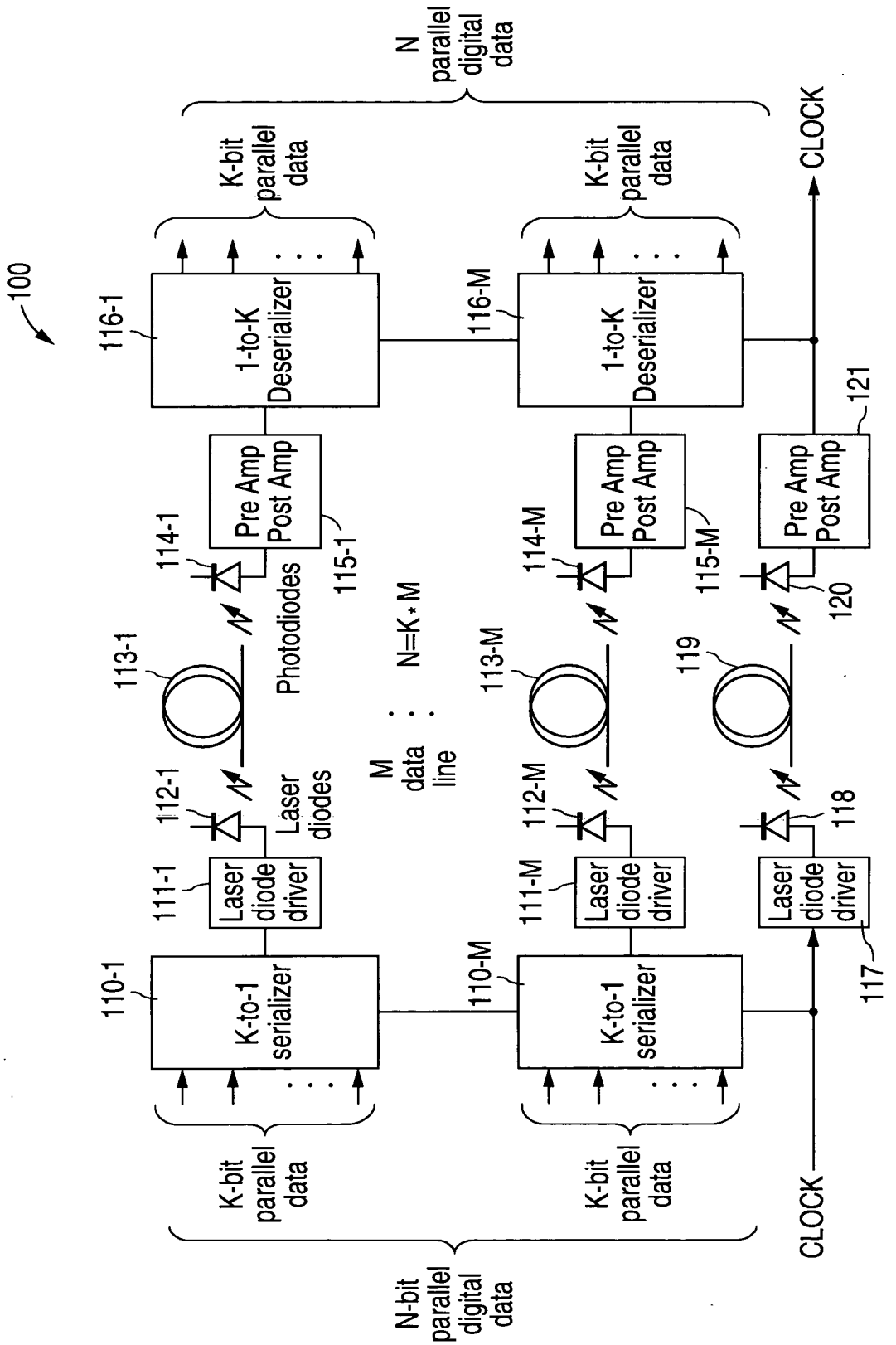


Figure 1B
(PRIOR ART)

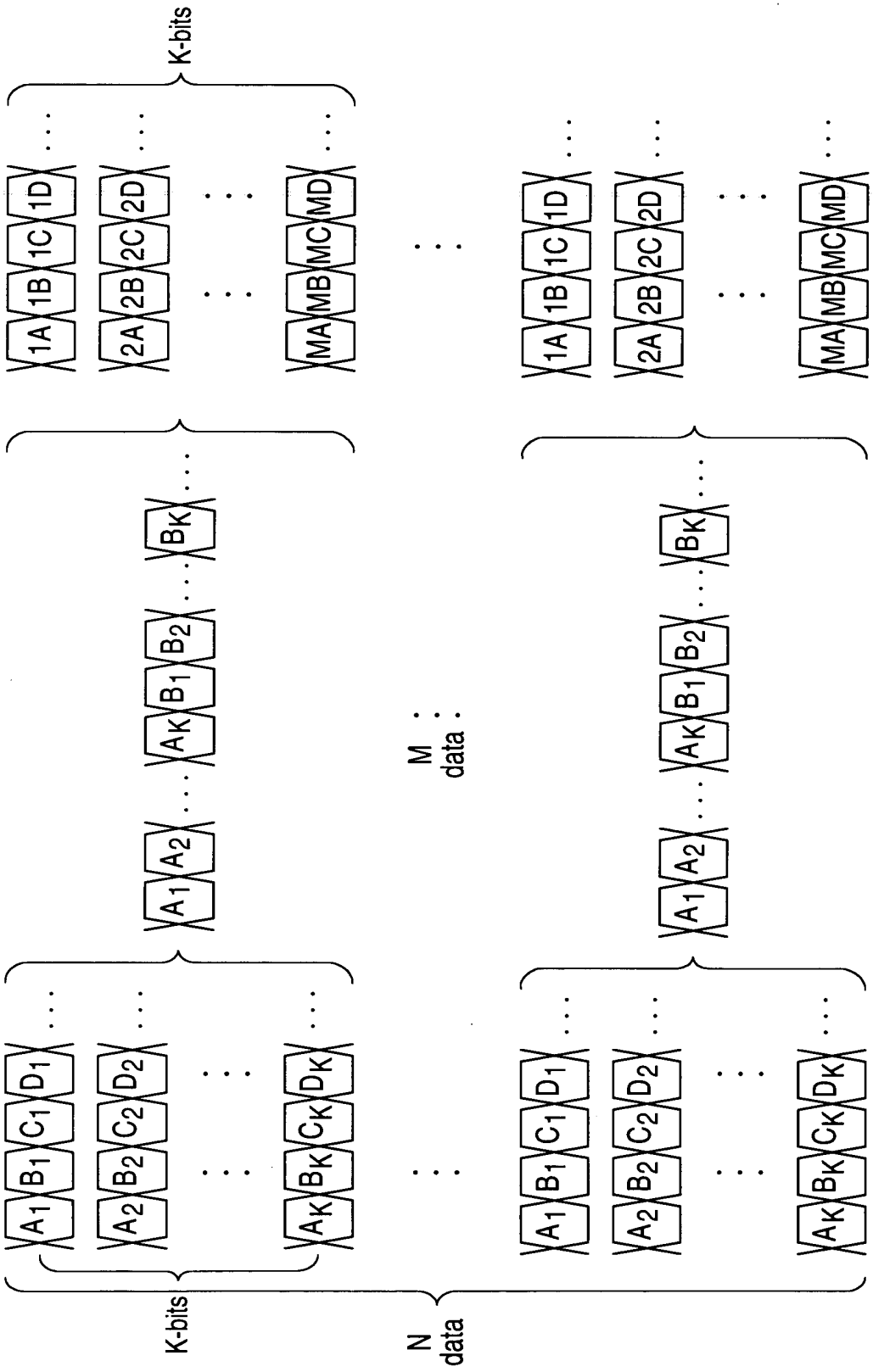


Figure 1C

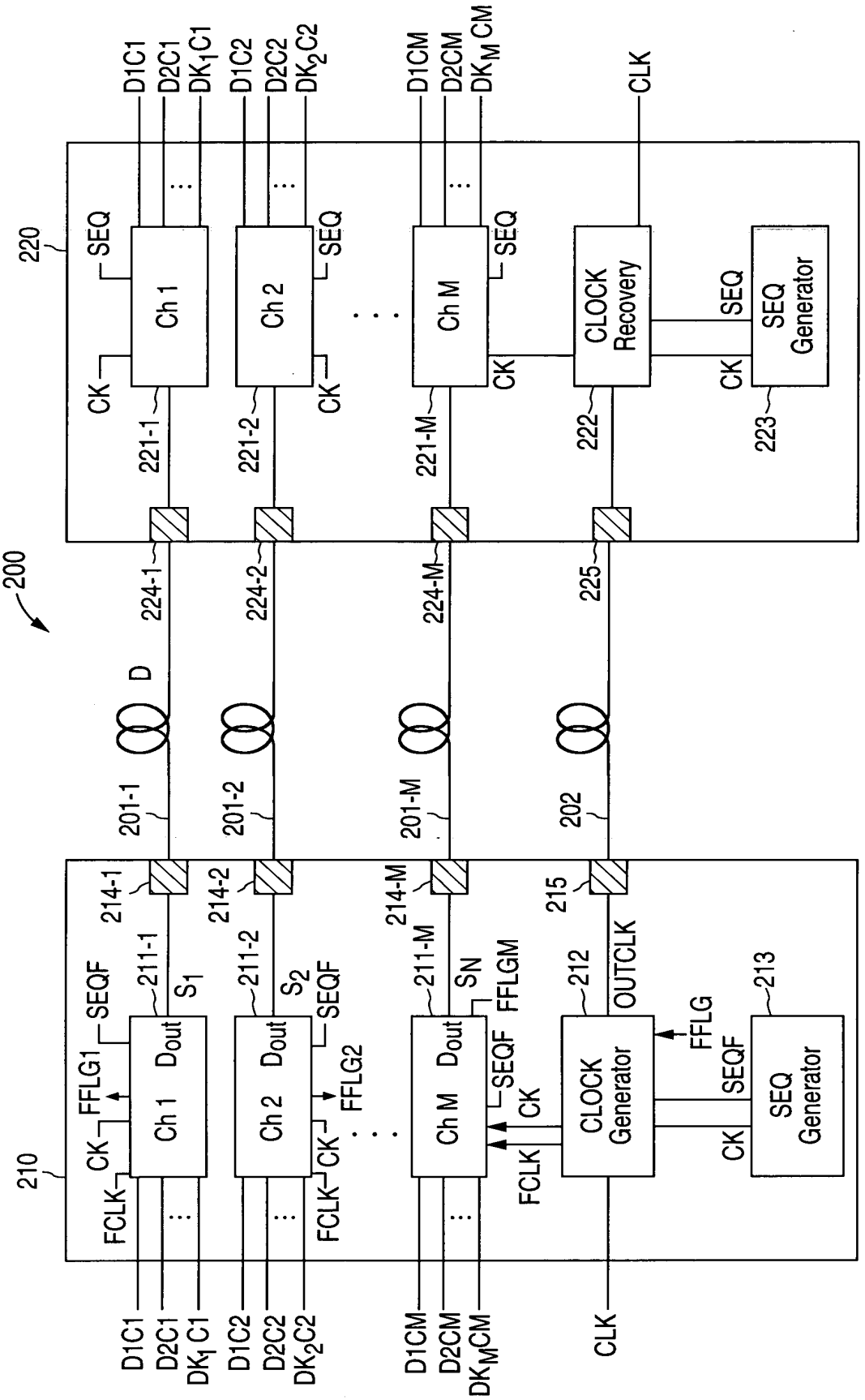

200
210
220
Ch 1
Ch 2
Ch M
CLOCK Recovery
SEQ Generator
CLOCK Generator
D1C1
D2C1
DK1C1
D1C2
D2C2
DK2C2
D1CM
D2CM
DKMCM
CLK
SEQ
CK
FCLK
FFLG1
FFLG2
FFLGM
SEQF
FFLG
OUTCLK
Dout
D
S1
S2
SN
201-1
201-2
201-M
202
211-1
211-2
211-M
212
213
214-1
214-2
214-M
215
221-1
221-2
221-M
222
223
224-1
224-2
224-M
225

Figure 2A

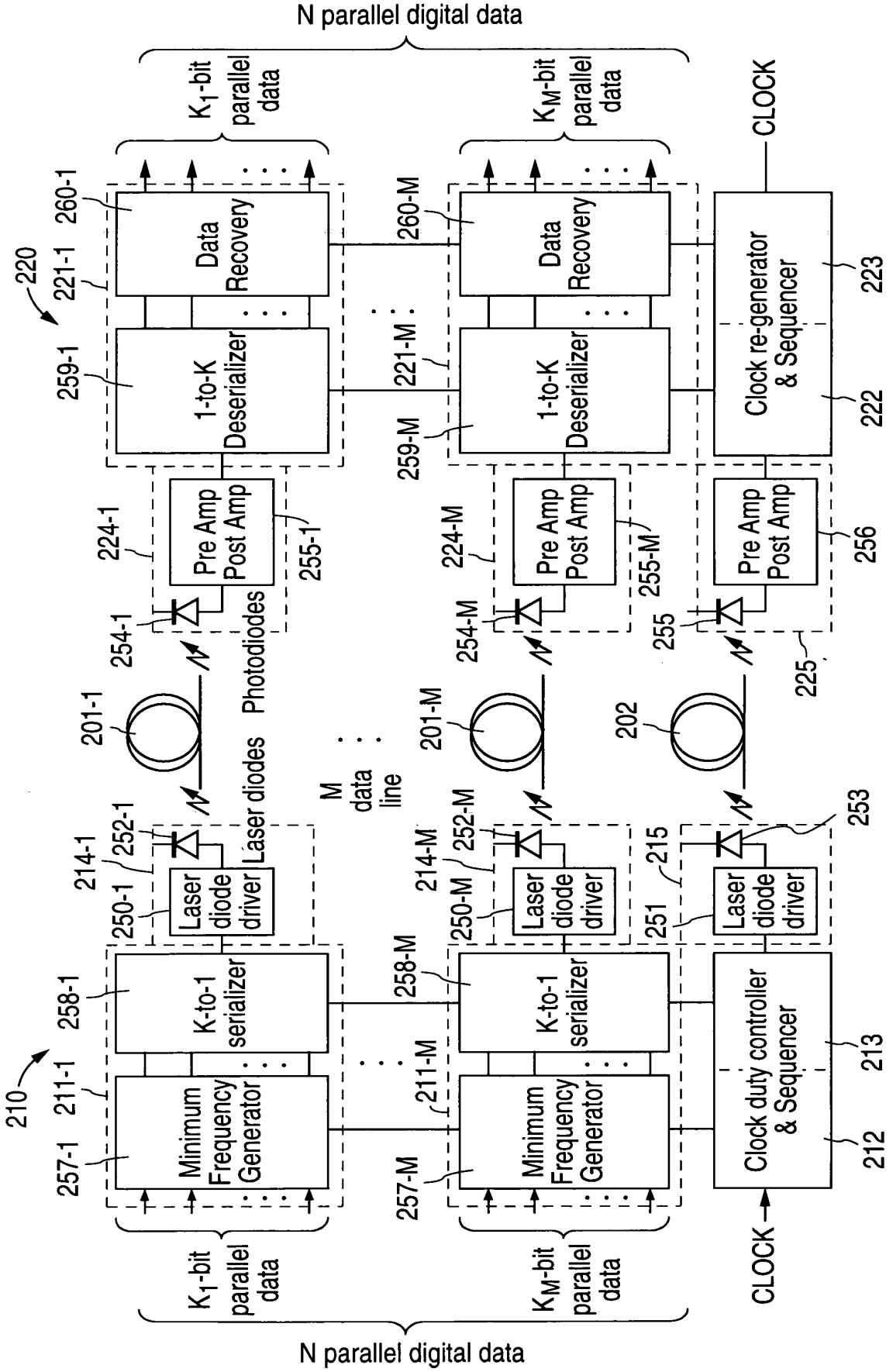

N parallel digital data
K_1-bit parallel data
K_M-bit parallel data
CLOCK
220
221-1
260-1
Data Recovery
259-1
1-to-K Deserializer
221-M
260-M
259-M
Clock re-generator & Sequencer
223
222
224-1
Pre Amp Post Amp
255-1
224-M
255-M
256
254-1
254-M
255
225
Photodiodes
201-1
201-M
202
M data line
Laser diodes
214-1
252-1
250-1
Laser diode driver
214-M
252-M
250-M
215
253
251
210
211-1
258-1
K-to-1 serializer
211-M
258-M
Minimum Frequency Generator
257-1
257-M
Clock duty controller & Sequencer
213
212
N parallel digital data

Figure 2B

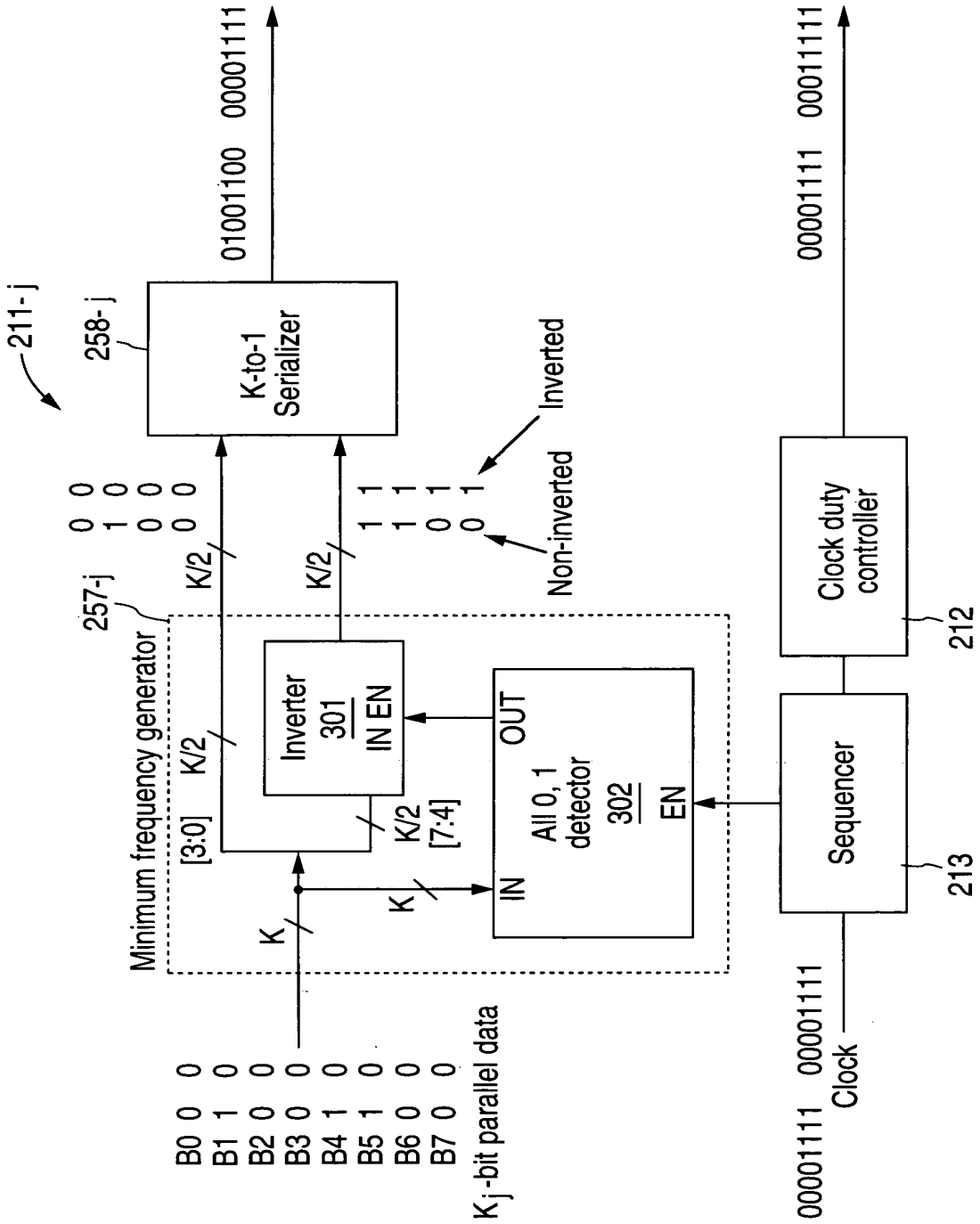

211-j
258-j
K-to-1 Serializer
01001100 00001111
Inverted
Non-inverted
0 0 0
1 0 0
0 0 0
1 1 1
0 1 1
0 1 1
257-j
Minimum frequency generator
K/2
K/2
[3:0]
K/2
[7:4]
Inverter
301
IN EN
OUT
All 0, 1
detector
302
EN
IN
K
K
Clock duty controller
212
Sequencer
213
0000111 00011111
0000111 00001111
Clock
B0 0 0
B1 1 0
B2 0 0
B3 0 0
B4 1 0
B5 1 0
B6 0 0
B7 0 0
Kj-bit parallel data

Figure 3

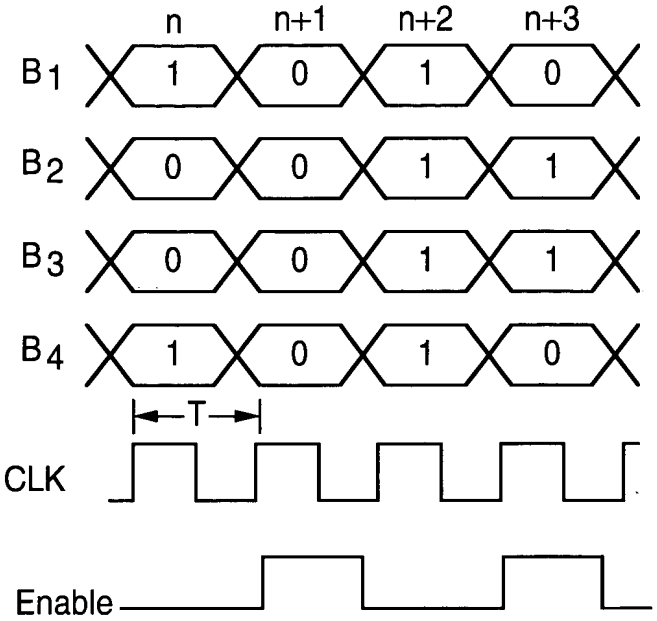


Figure 4A

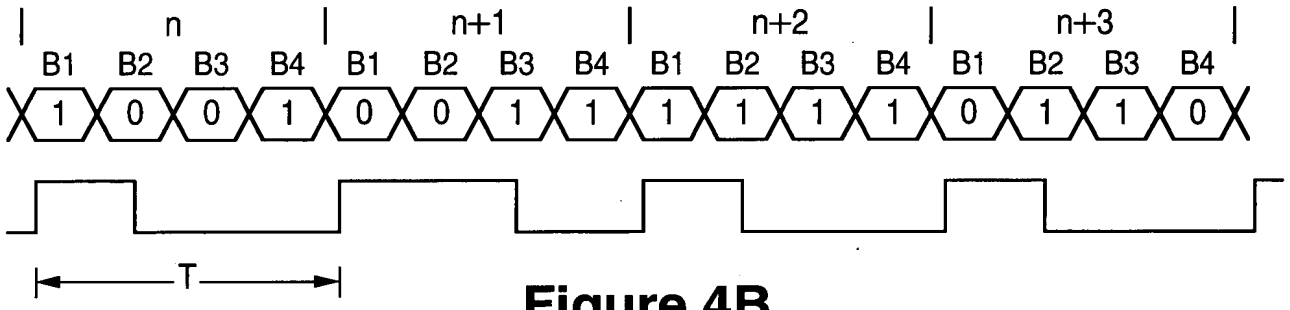


Figure 4B

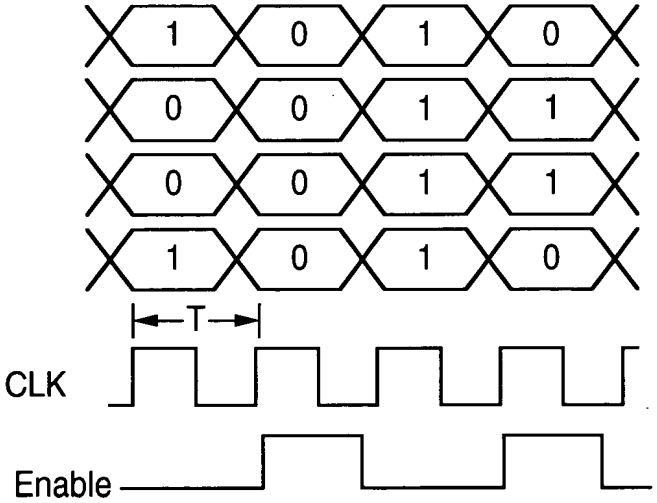


Figure 4C

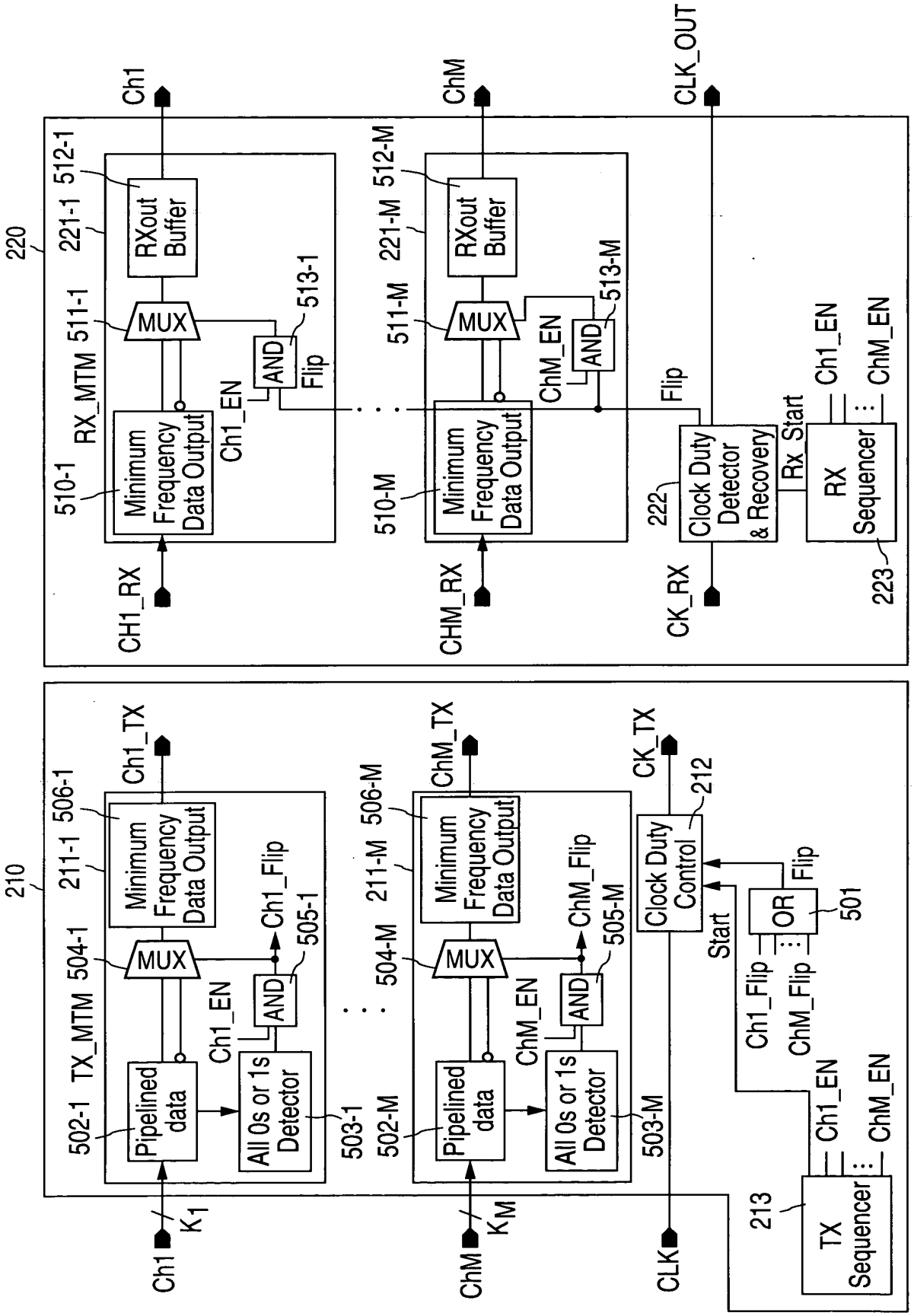


Figure 5A

Figure 5B

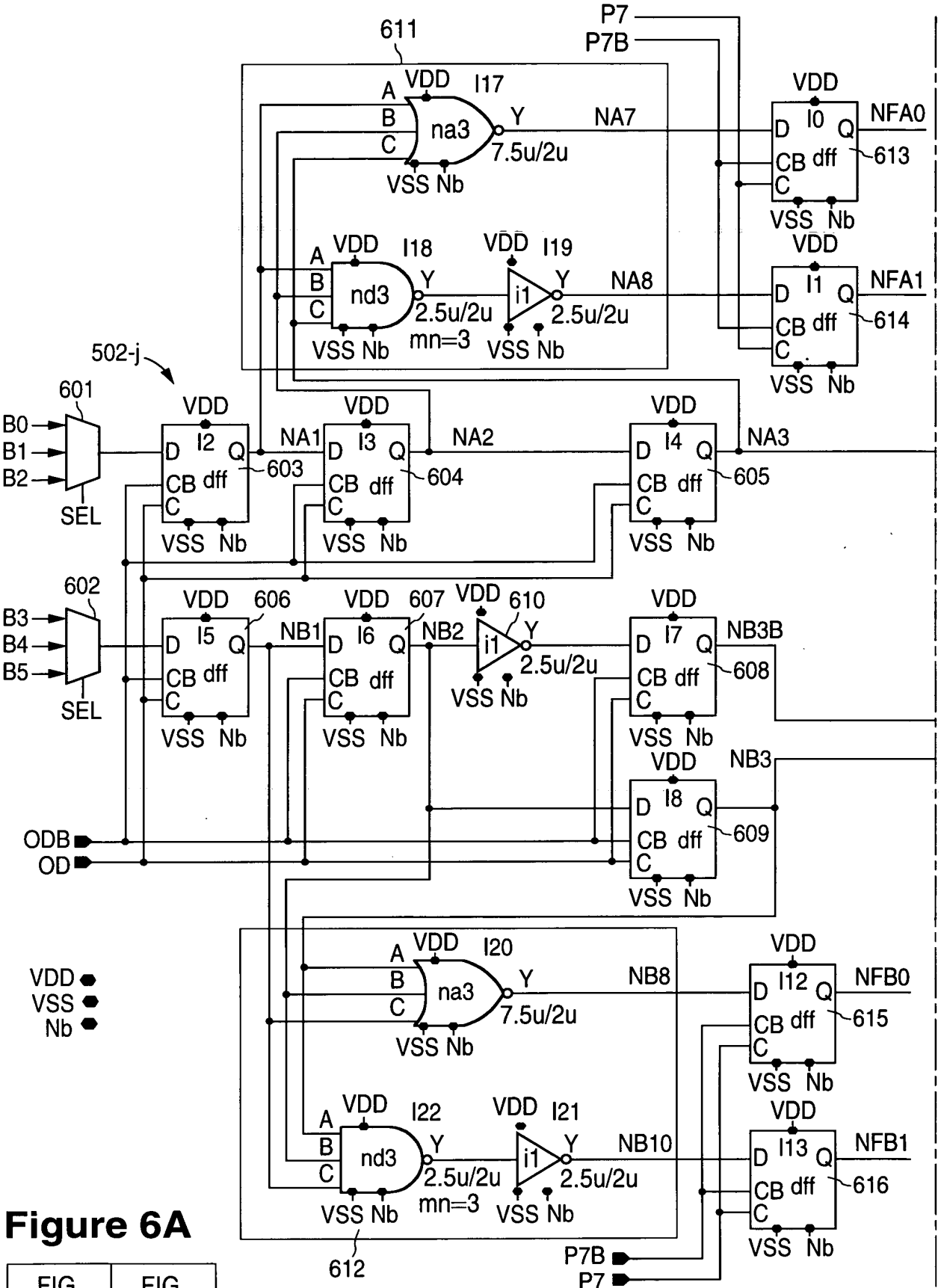


Figure 6A

FIG. 6A	FIG. 6B

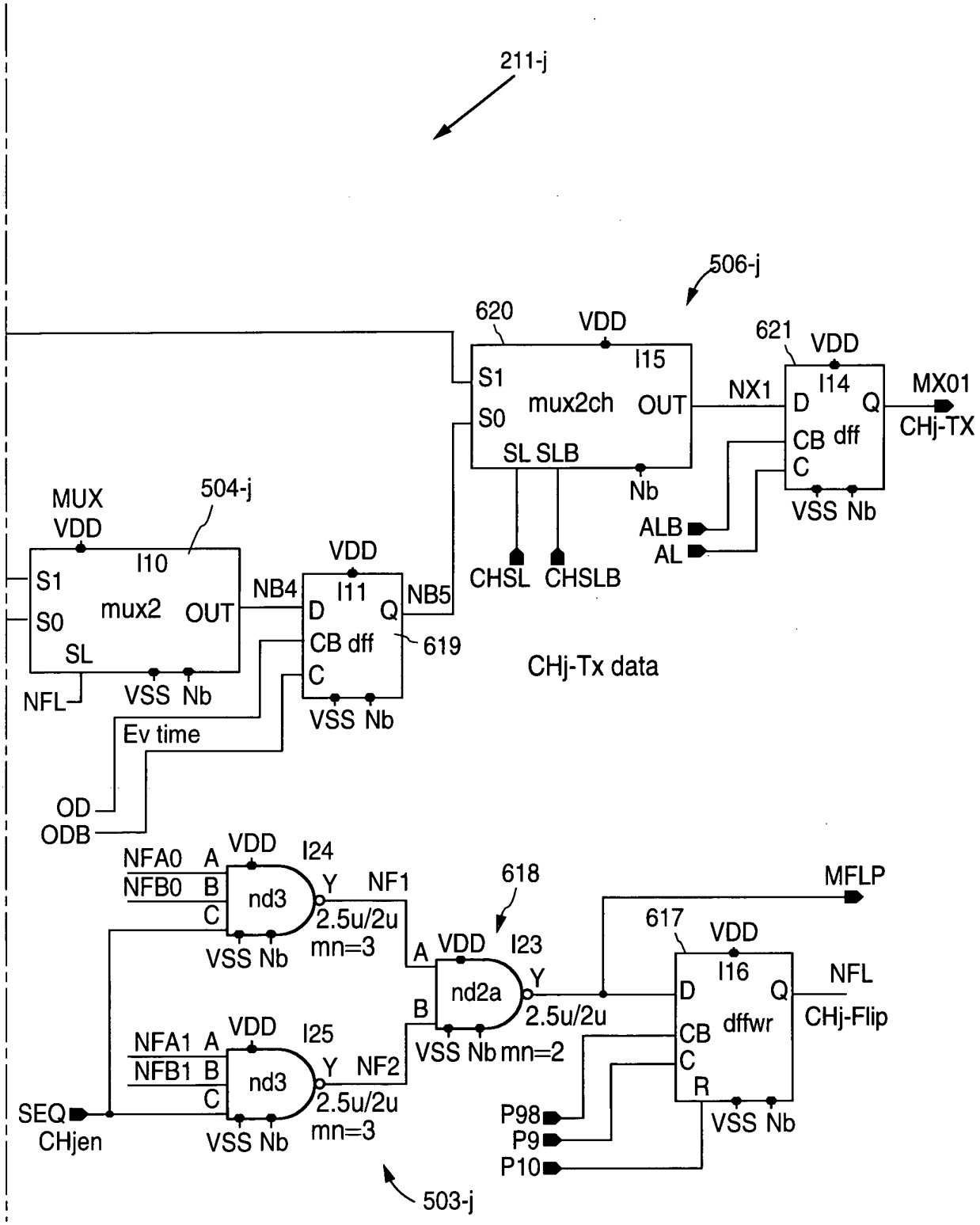

211-j
506-j
620
VDD
I15
S1
S0
mux2ch
OUT
SL SLB
Nb
621
VDD
I14
D
Q
CB dff
C
VSS Nb
NX1
MX01
CHj-TX
ALB
AL
CHSL
CHSLB
MUX
VDD
504-j
I10
S1
S0
mux2
OUT
SL
NFL
VSS Nb
NB4
VDD
I11
D
Q
CB dff
C
VSS Nb
NB5
619
CHj-Tx data
Ev time
OD
ODB
NFA0
NFB0
A
B
C
VDD
I24
nd3
Y
NF1
2.5u/2u
mn=3
VSS Nb
618
A
VDD
I23
nd2a
B
Y
2.5u/2u
VSS Nb mn=2
MFLP
617
VDD
I16
D
Q
CB
C
R
dffwr
NFL
CHj-Flip
VSS Nb
NFA1
NFB1
A
B
C
VDD
I25
nd3
Y
NF2
2.5u/2u
mn=3
VSS Nb
SEQ
CHjen
P98
P9
P10
503-j

Figure 6B

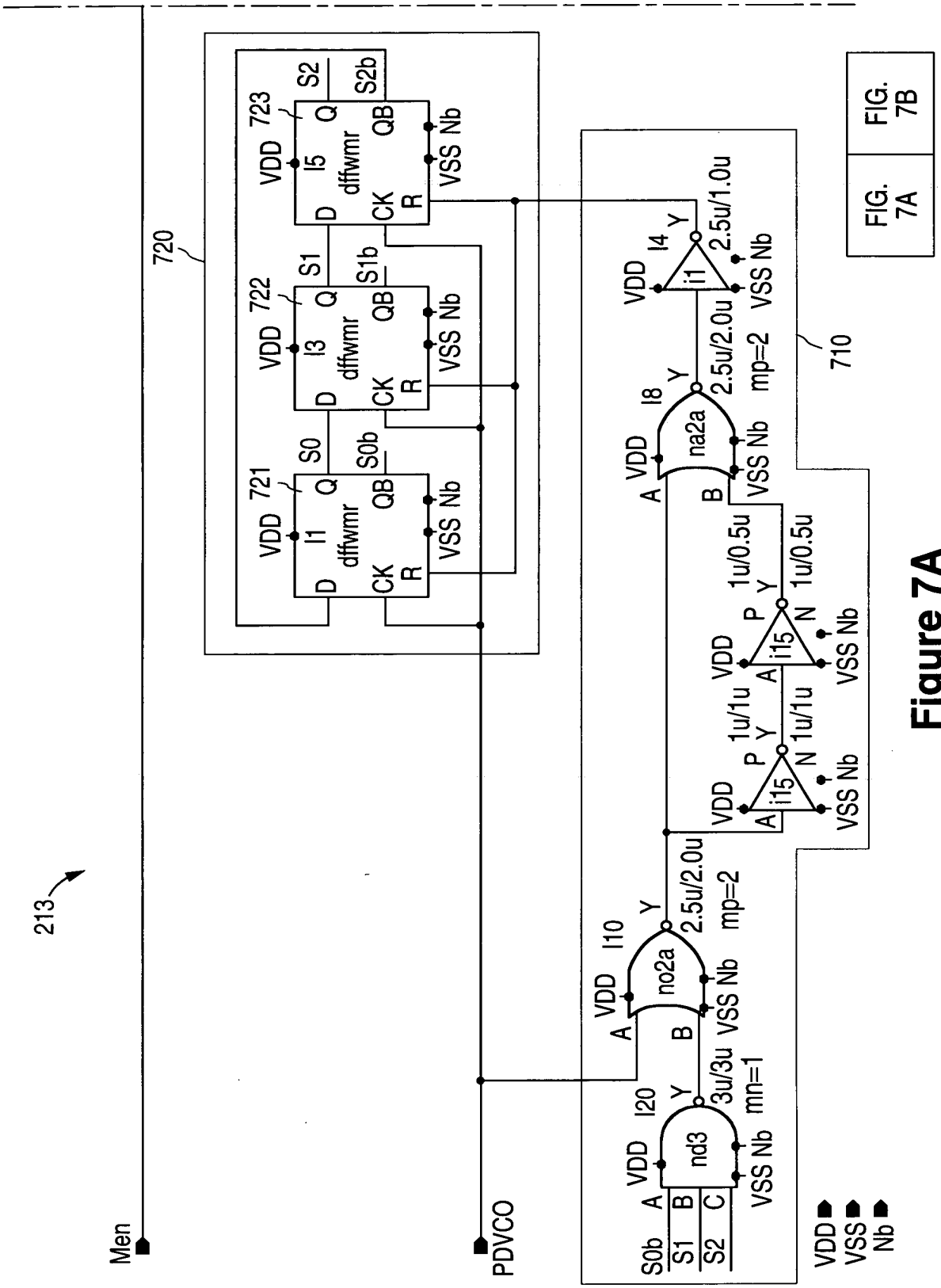


FIG. 7A
FIG. 7B
720
710
213
Men
PDVCO
VDD
VSS
Nb
723
722
721
dffwmr
S2
S2b
S1
S1b
S0
S0b
VSS Nb
I4
I8
I10
I20
I15
na2a
no2a
nd3
2.5u/1.0u
2.5u/2.0u
mp=2
3u/3u
mn=1
1u/0.5u
1u/1u

Figure 7A

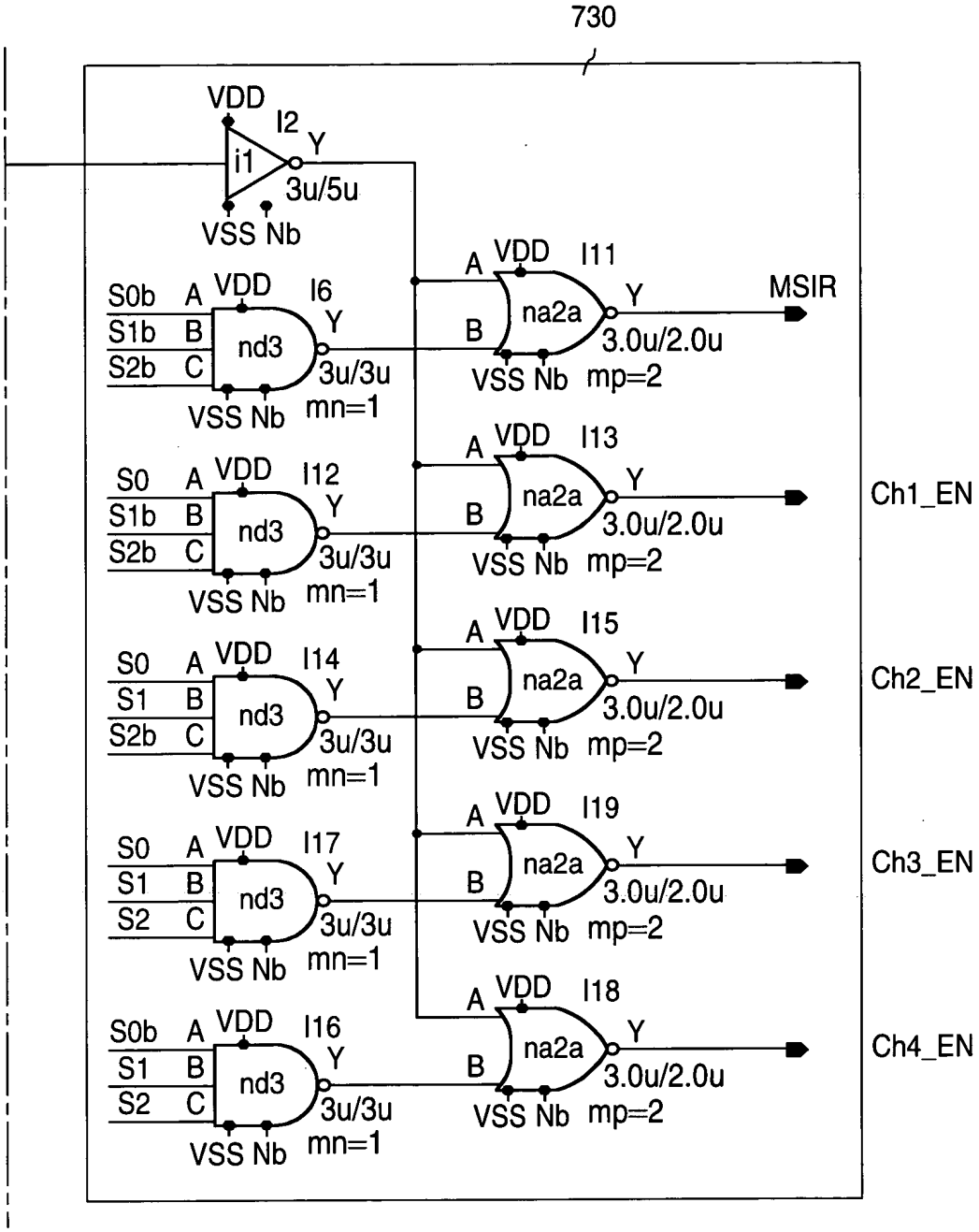

730
VDD
I2
i1
Y
3u/5u
VSS Nb
S0b
S1b
S2b
A
B
C
VDD
I6
nd3
Y
3u/3u
mn=1
VSS Nb
I11
na2a
3.0u/2.0u
mp=2
MSIR
S0
S1
I12
I13
Ch1_EN
I14
I15
Ch2_EN
I17
I19
Ch3_EN
I16
I18
Ch4_EN

Figure 7B

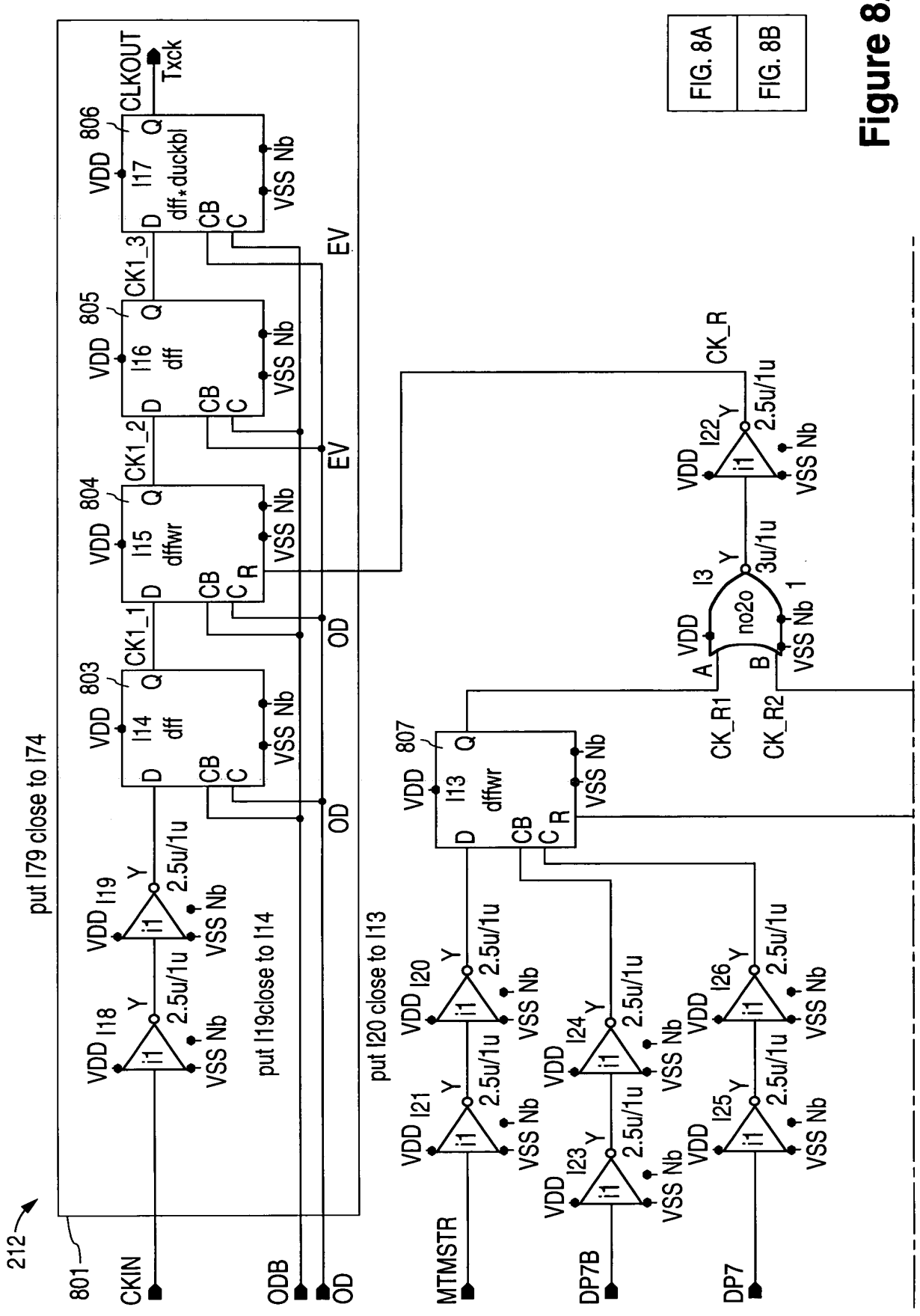
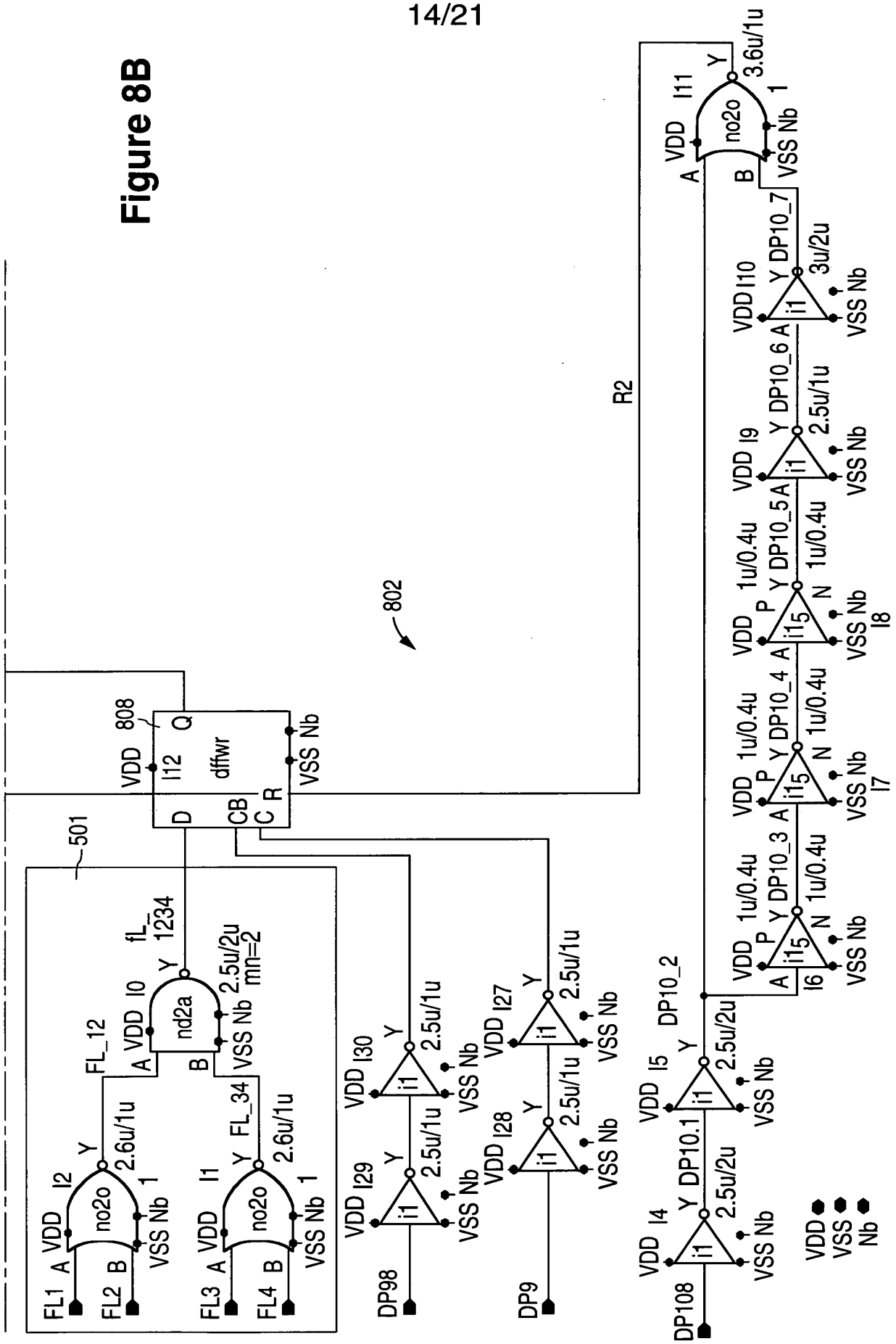


FIG. 8A
FIG. 8B
212
801
CKIN
ODB
OD
MTMSTR
DP7B
DP7
CLKOUT
Txck
CK1_3
CK1_2
CK1_1
CK_R
CK_R1
CK_R2
EV
OD
put I79 close to I74
put I19close to I14
put I20 close to I13
VDD
VSS Nb
2.5u/1u
3u/1u
dff_duckbl
dff
dffwr
no2o

Figure 8A

Figure 8B


802
808
501
R2
VDD
VSS Nb
dffwr
nd2a
no2o
i1
i15
2.6u/1u
2.5u/2u
2.5u/1u
1u/0.4u
3.6u/1u
3u/2u
FL1
FL2
FL3
FL4
FL_12
FL_34
DP98
DP9
DP108
DP10_2
DP10.1
DP10_3
DP10_4
DP10_5
DP10_6
DP10_7
I0
I1
I2
I4
I5
I6
I7
I8
I9
I10
I11
I12
I27
I28
I29
I30

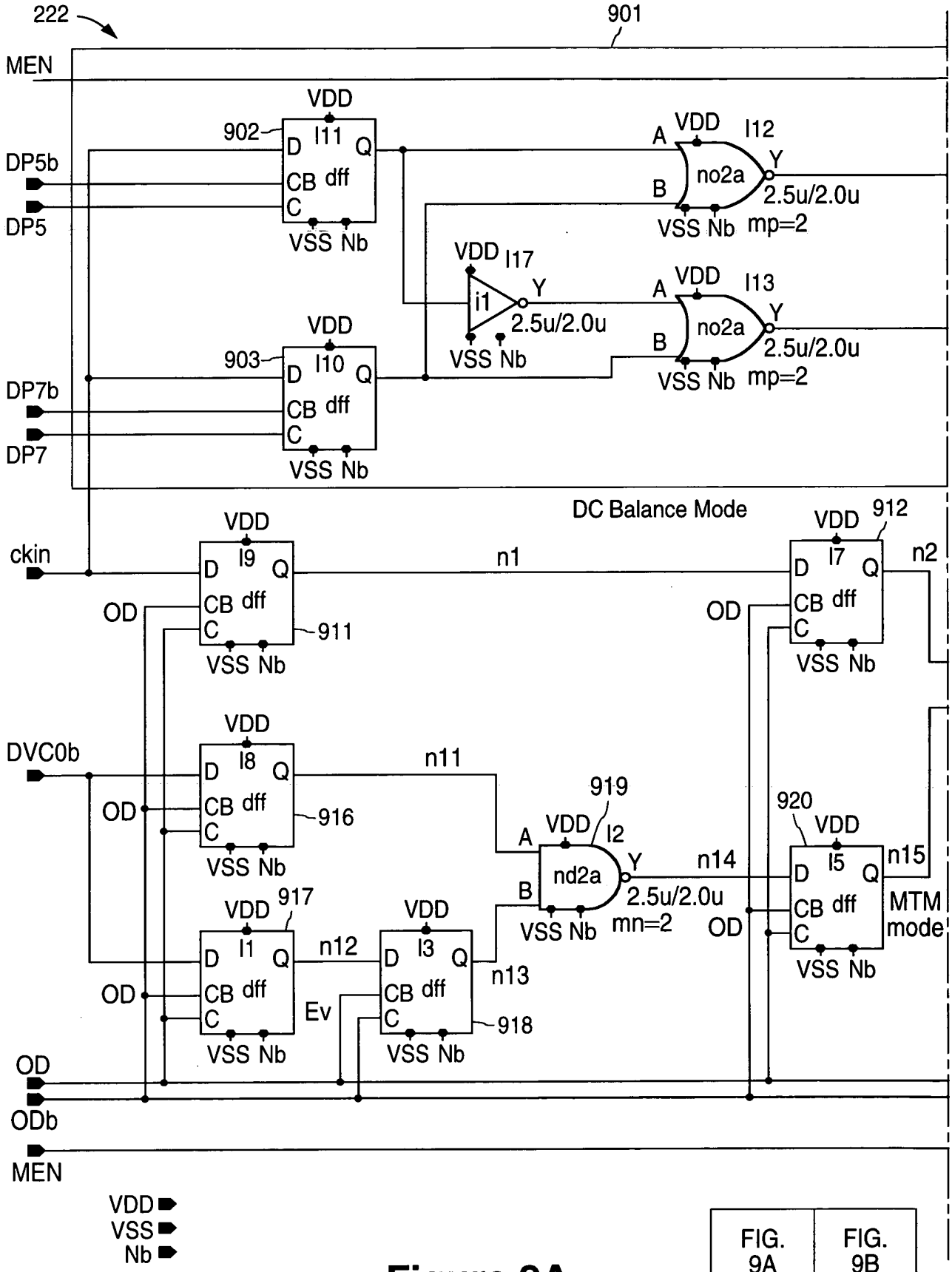


FIG. 9A	FIG. 9B

Figure 9A

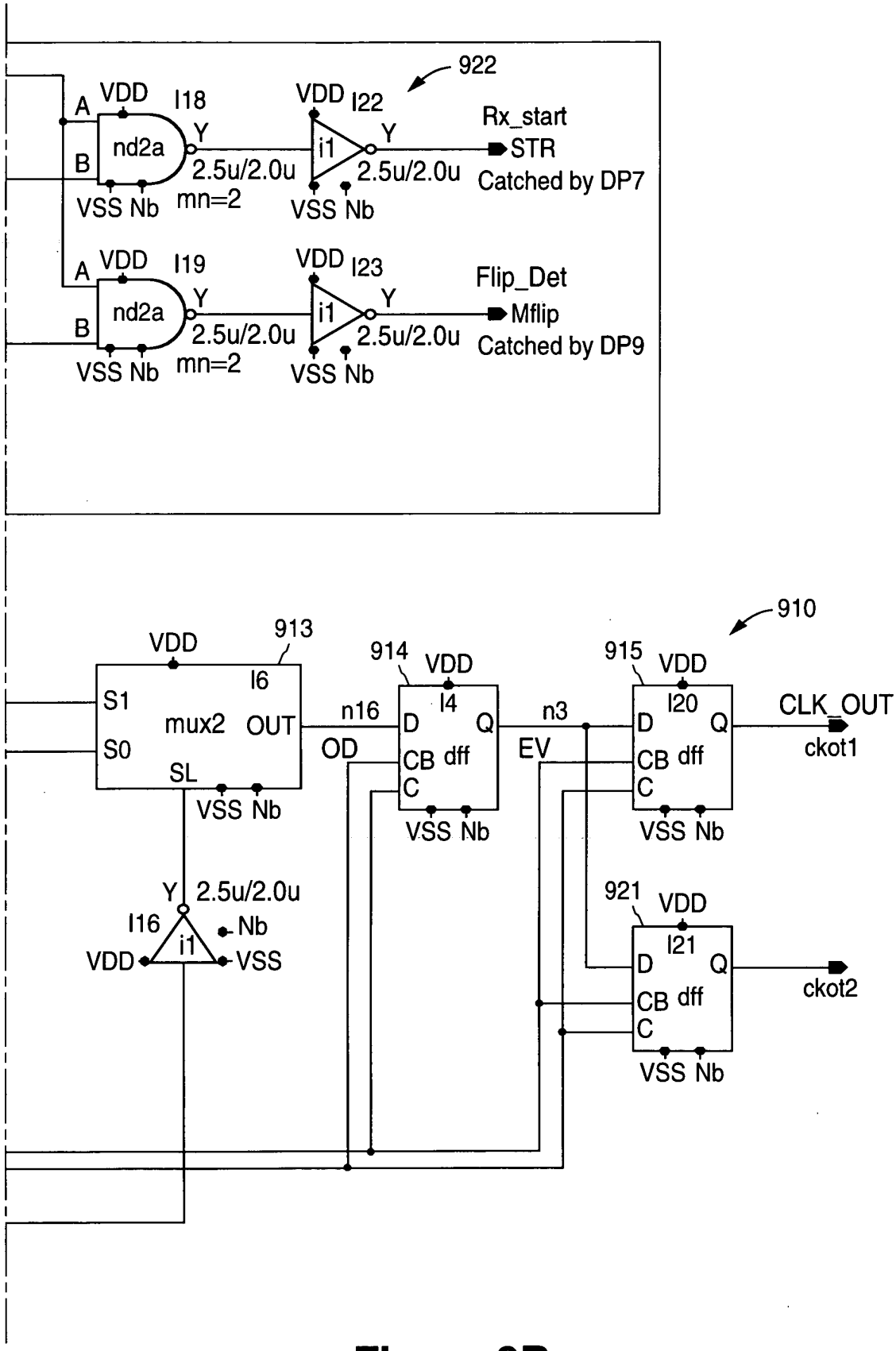

922
A
B
VDD
I18
nd2a
Y
2.5u/2.0u
mn=2
VSS Nb
VDD
I22
i1
Y
2.5u/2.0u
VSS Nb
Rx_start
STR
Catched by DP7
A
B
VDD
I19
nd2a
Y
2.5u/2.0u
mn=2
VSS Nb
VDD
I23
i1
Y
2.5u/2.0u
VSS Nb
Flip_Det
Mflip
Catched by DP9
910
VDD
913
S1
S0
SL
I6
mux2
OUT
VSS Nb
n16
OD
914
VDD
I4
D
CB
C
dff
Q
VSS Nb
n3
EV
915
VDD
I20
D
CB
C
dff
Q
VSS Nb
CLK_OUT
ckot1
Y
2.5u/2.0u
I16
i1
Nb
VDD
VSS
921
VDD
I21
D
CB
C
dff
Q
VSS Nb
ckot2

Figure 9B

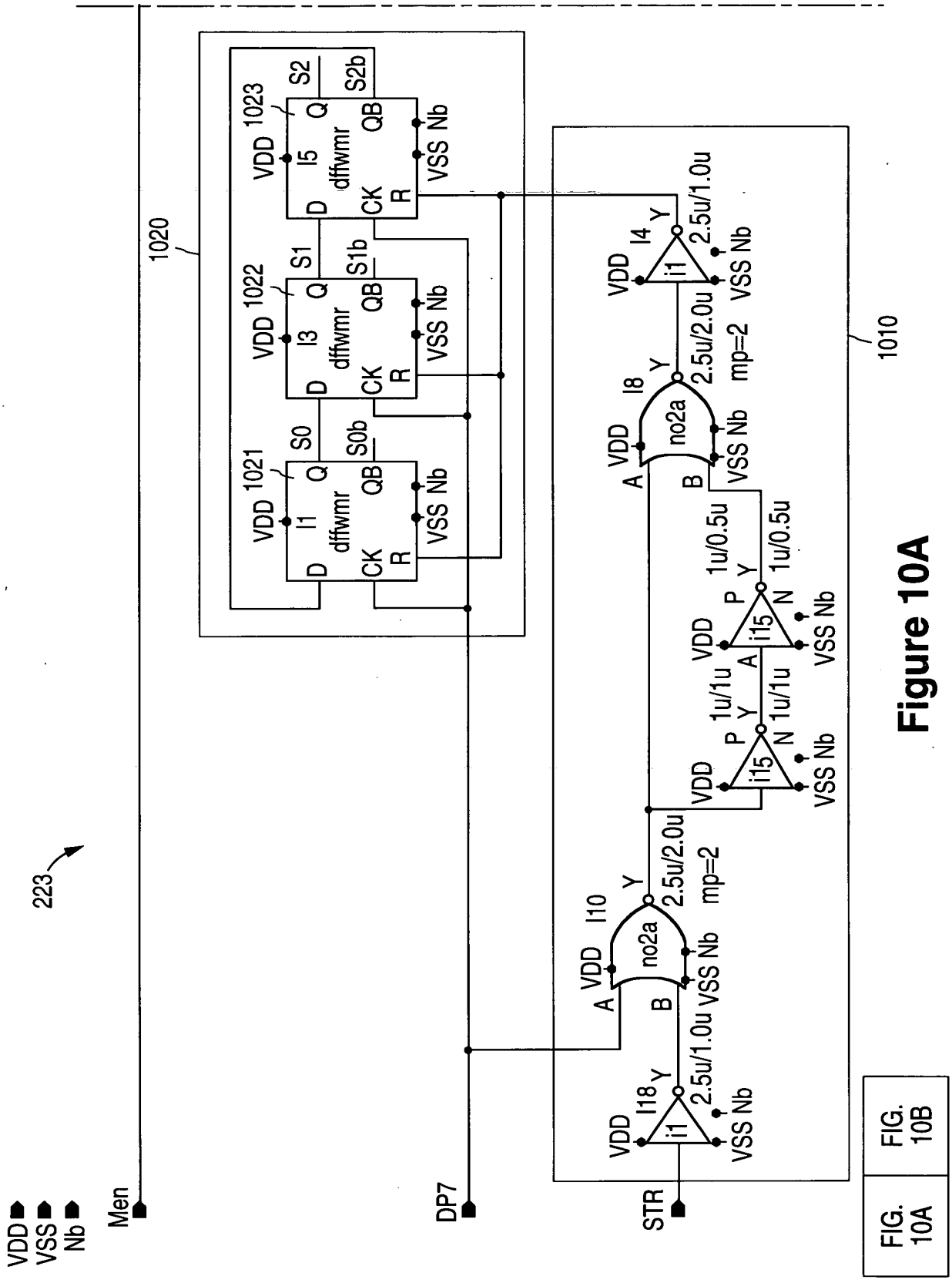

VDD
VSS
Nb
Men
223
1020
1021
1022
1023
dffwmr
D
CK
R
Q
QB
S0
S0b
S1
S1b
S2
S2b
VSS Nb
1010
DP7
STR
no2a
A
B
mp=2
2.5u/2.0u
2.5u/1.0u
1u/0.5u
1u/1u
P
N
FIG. 10A
FIG. 10B

Figure 10A

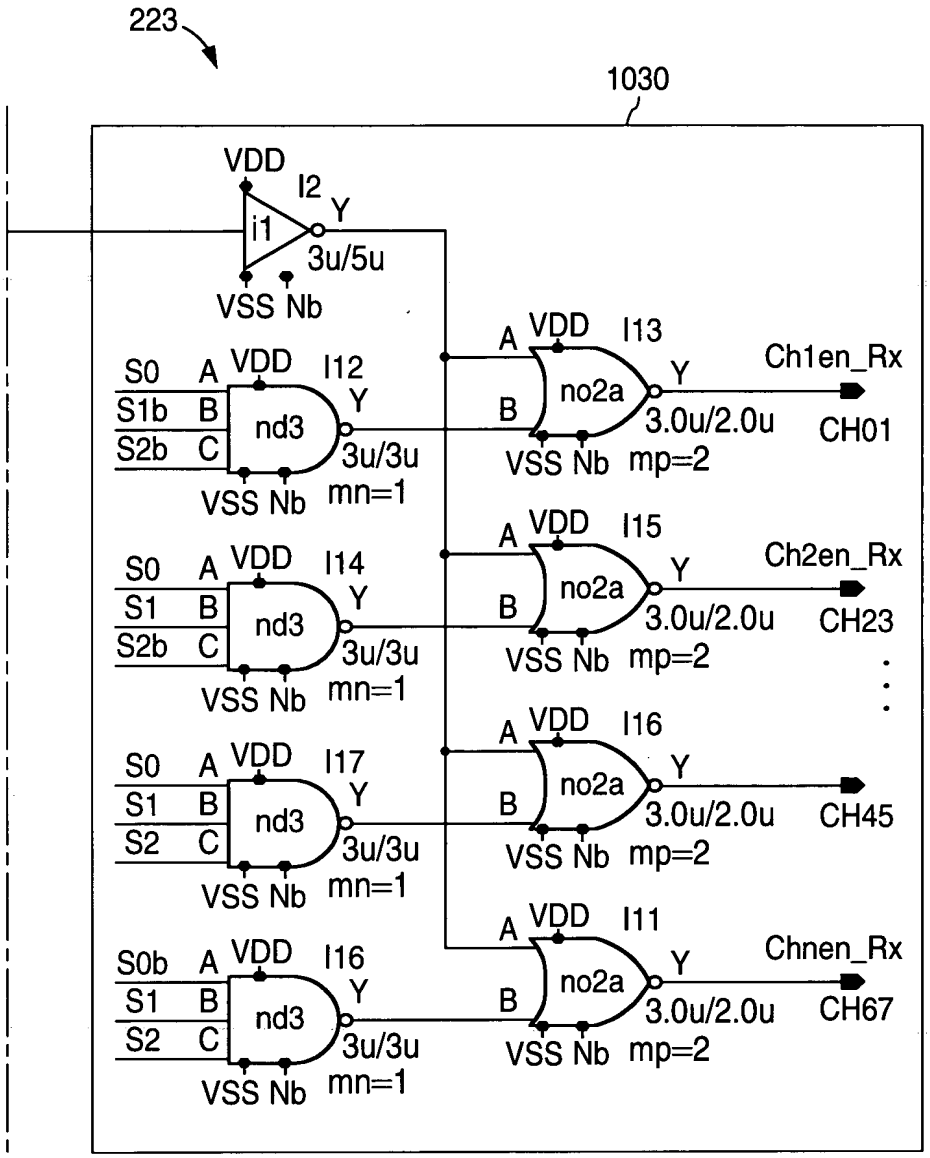

223
1030
VDD
I2
i1
Y
3u/5u
VSS Nb
S0
S1b
S2b
A
B
C
VDD
I12
nd3
Y
3u/3u
mn=1
VSS Nb
I13
no2a
3.0u/2.0u
mp=2
Ch1en_Rx
CH01
I15
Ch2en_Rx
CH23
I16
CH45
S1
S2
I17
S0b
I11
Chnen_Rx
CH67

Figure 10B

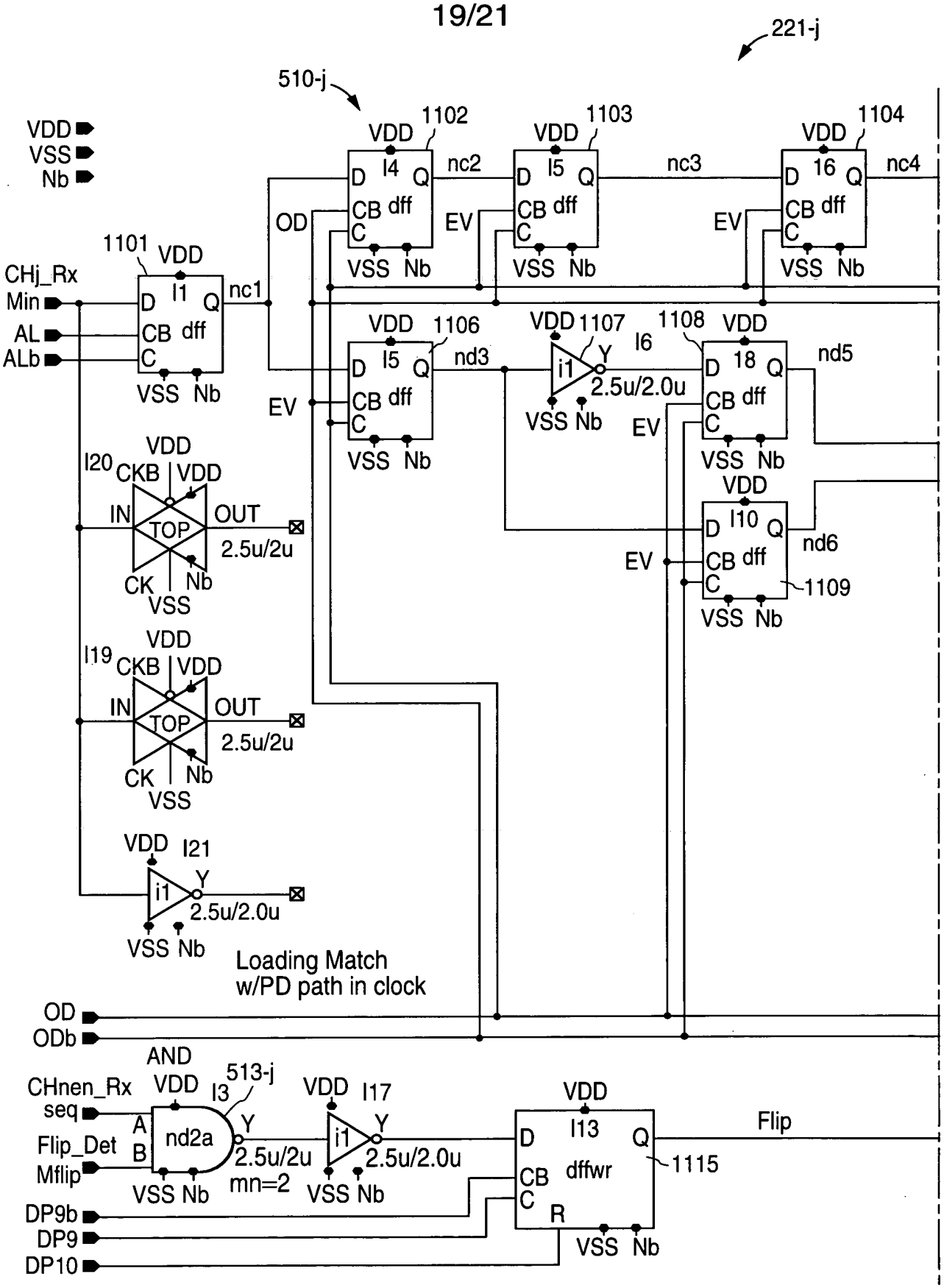


Figure 11A

FIG. 11A	FIG. 11B

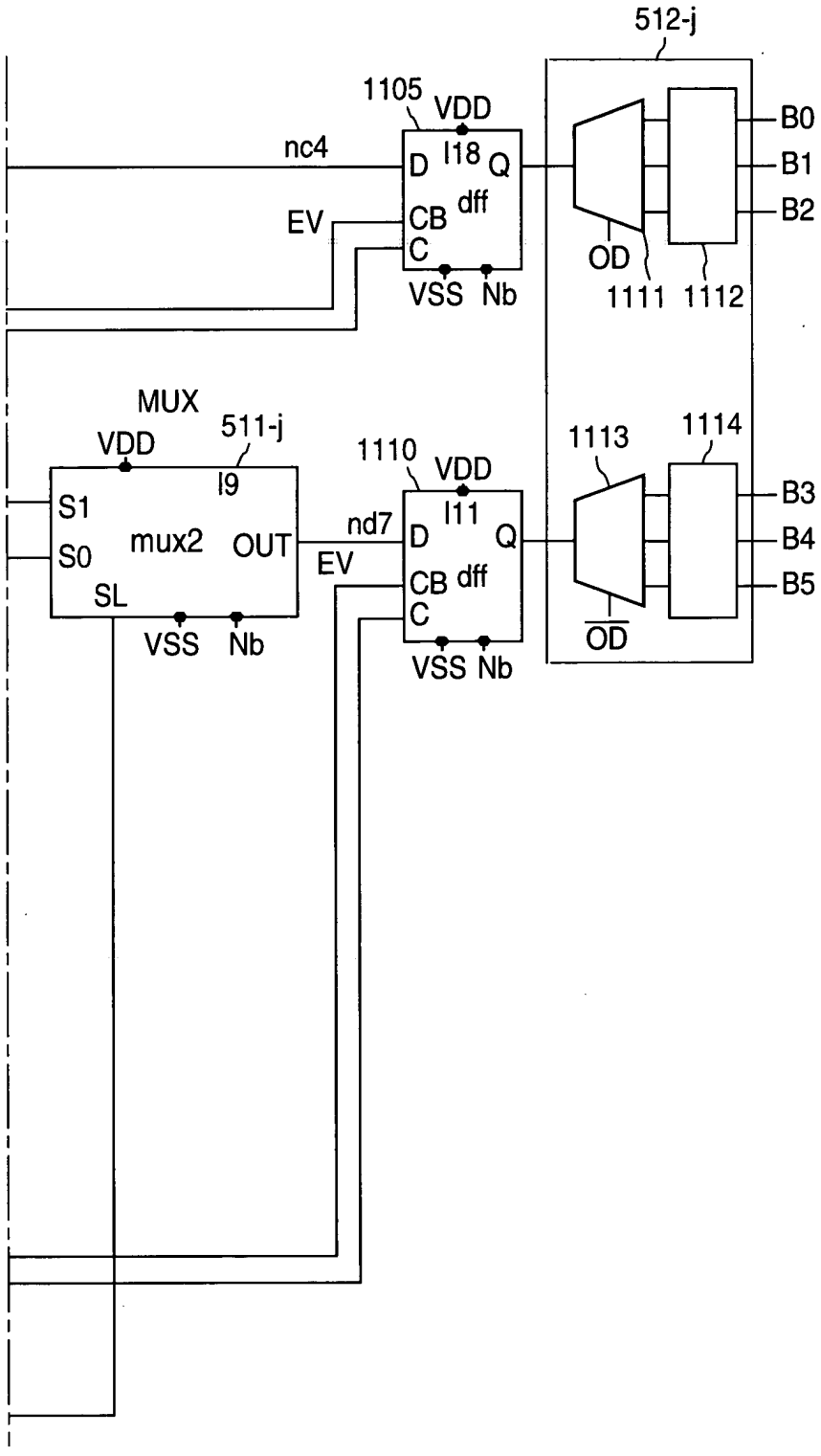

512-j
1105
VDD
nc4
D
I18
Q
dff
EV
CB
C
VSS
Nb
OD
1111
1112
B0
B1
B2
MUX
VDD
511-j
I9
S1
S0
mux2
OUT
SL
VSS
Nb
1110
VDD
I11
nd7
D
Q
EV
CB
dff
C
VSS
Nb
1113
1114
OD
B3
B4
B5

Figure 11B

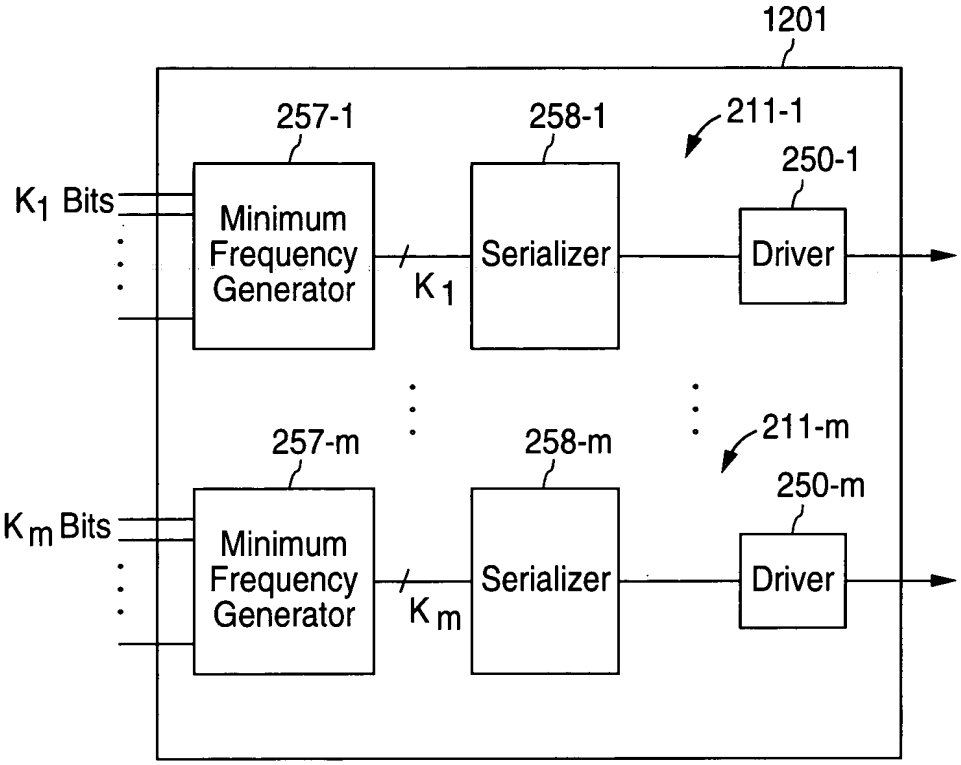


Figure 12A

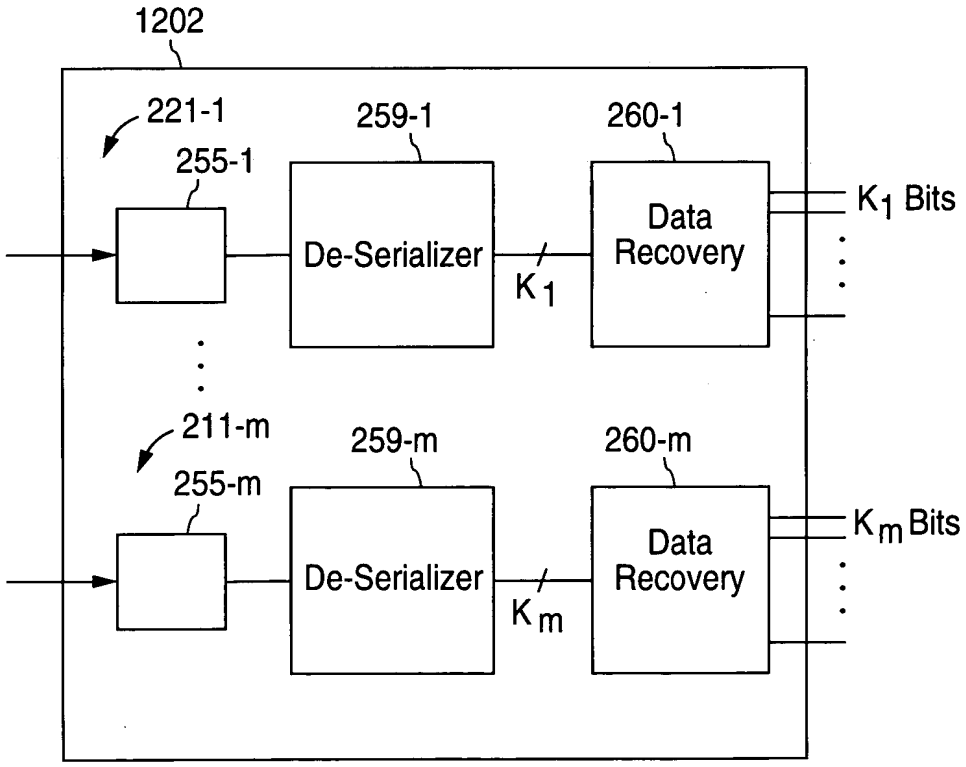


Figure 12B